

## SECTION 828

### VEHICLE LOOP DETECTOR AND LOOP DETECTOR WIRE

#### 828.01. DESCRIPTION.

This work shall consist of furnishing materials and installing a solid state digital inductive vehicle loop detector and loops in accordance with these Specifications, the latest NEMA TS-1 Specifications, and as shown on the Plans.

#### 828.02. MATERIALS.

- (a) **Detector Loop Wire.** The detector loop wire that is embedded in the pavement for the detector loop shall be IMSA 51-1, IMSA 51-3 or IMSA 51-5 wire and shall meet the requirements of Subsection 738.01(c) of Section 700.
- (b) **Shelf Mounted Detector Unit.** The detector unit shall be self-contained, self-tuning solid state digital and shall compensate automatically for variations in temperature and environmental conditions.
  - 1. **Mechanical Requirements.** The complete detector unit, including power supply, shall be completely enclosed in a sheet metal housing with a protective paint finish. The case shall be so designed to provide convenient access to the entire interior assembly to permit easy testing and servicing of parts. Each detector unit shall be supplied with a connecting cable. Electrical connection from the detector to the incoming and outgoing circuits shall be made by inserting a multi-terminal plug into the plug receptacle located on the face panel of the detector. The detector shall be replaceable with a similar unit without the necessity of disconnecting and reconnecting the individual wires leading therefrom.
  - 2. **Output Delay and Extend.** The loop detector unit shall be supplied with programmable delay and extend output features.
    - 2.1. **Delay Output.** Furnish a variable delay circuit to provide a delayed output. This circuit shall be variable from zero to at least 20 seconds in one second increments. Detection of a vehicle shall be delayed for the amount of time selected, thereby providing no detector output until a vehicle has been present in the loop for this length of time. This timing shall reset each time the loop is vacated. However, the delay circuit shall be disabled immediately when 120 VAC is present on pin J of the MS 3106A-18 1P connector for this channel.
    - 2.2. **Extend Output.** Furnish a variable extend circuit to provide a carryover output. This circuit shall be variable from zero to at least 15 seconds in 0.25 second increments. Detector actuation shall be extended after the vehicle leaves the loop. The timing circuit shall reset after the extension has expired. However, the extend circuit shall not be disabled when 120 VAC is present at Pin J of the connector described again.

The timing shall be digital and all programming settings shall be accomplished by pins, thumbwheels or dip switches. The delay and extend features described herein shall not be required to function simultaneously unless otherwise specified on the Plans.

All programming (extend, delay, retention of presence, etc.) shall be external and located on the face of unit.

3. *Operating Requirements.* Design the detector so that environmental metal objects in the vicinity of the loop shall not affect its operation. The circuit design shall permit the lead-in cable described in Section 834 to be placed in a common conduit with signal and interconnect cable without any interference to the operation of the detector.

Also design the detector to operate satisfactorily in temperatures ranging from -30°F to 160°F (-34° C to 71° C) and to operate satisfactorily on line voltage of single phase 120 volts 60 cycle alternating current. This voltage may vary  $\pm 15$  percent without any noticeable affect of the operation or life of the detector equipment. The detector unit shall have a tuning range of loop inductance from 40 to 700 microhenries. The detector shall also be capable of detecting vehicles traveling at speeds ranging from 0 to 160 km/hr, and shall detect only those vehicles that pass over any portion of the loop. Should power fail momentarily, the detector, when power is restored, shall return to its condition at the time of the power failure. If in the rest condition, it shall return to the rest condition, or if in detect condition, it shall return to the detect condition.

4. *Electrical Requirements.* Circuitry of the detector shall be all solid state. The printed circuit board shall be as described in Section 825. Facilities for adjusting the detector shall be an integral part of the detector on the front panel. Loop tuning shall be a simplified procedure which may be performed without traffic activity and without the need of test apparatus. There shall be two operating modes, pulse and presence. The operating mode shall be independently selected for each detector by means of switches located on the front of the detector unit. Each detector unit shall be furnished with an EDCO SRA-16C-1 surge protector, or an approved equal, in order to protect the detector unit from lightning or other like disturbance. The detector shall be provided with a multiconductor color coded harness and connector of the MS type. Provide each detector unit with a fuse replaceable without tools, located on the front panel. Permanently ground each detector unit internally. Visual indication of vehicle detection shall be provided by an indicator light located on the front panel.
- (c) **Card Rack Detector Unit.** The card rack detector units shall be 2-channel, self tuning, solid state, digital, and shall compensate automatically for variations in temperature and environmental conditions. They shall meet the requirements of NEMA TS-1 and the general requirements of Section 828.02 (b) of this specification.
  - (d) **Card Rack Assembly.** The card rack shall accommodate a minimum of eight (8) detector units. The card rack shall be crosswired for two-channel or four-channel operation.

The detector card rack frame shall be fabricated from aluminum and shall have slots set in a modular fashion such that the PCB edge connectors shall plug into the rear while sliding between top and bottom card guides for each module. Mounting flanges shall be provided and be turned outward for ease of access. The detector card rack shall be hinged on one side and fastened with thumb screw type connectors on the other in order for the unit to swing out for maintenance purposes. Enough slack shall be provided in the wiring to allow for the unit to swing out.

- (e) **Power Supply.** The power supply shall be a 24 VDC power supply capable of supplying a minimum of 3.6 amperes. For a shelf mounted power supply the front panel of the power supply shall provide a power on LED, a power on-off switch, an appropriate sized fuse for the 120 VAC input line, and a connector. The connector shall have a metallic shell which is connected to the chassis ground internally and shall mate with an MS-3106A-18-1SW cable connector.

Connector PIN terminations shall be as follows:

PIN	Function
A	AC Neutral
B	Reserved
C	120 VAC Line
D	Reserved
E	24 VDC Output
F	Reserved
G	Logic Ground
H	Chassis Ground
I	Reserved
J	Reserved

- (f) **Vehicle Loop Wire Sealant.** This section shall govern for furnishing and installing loop wire sealant for use in the installation of vehicle detector loops in asphaltic and concrete pavement as shown on the plans.
1. *General Requirements.* The sealant shall be a one-part polyurethane material and shall be suitable for use in both asphaltic and concrete pavement. The sealant shall be designed to enable traffic to pass over the filled slot immediately after application without tracking or stringing. The sealant shall not shrink in volume during or after its curing process.
  2. *Physical Properties.* The sealant shall have a minimum shelf life to 12 months. The sealant shall have certain physical properties in its uncured and cured states. They are as follows:

2.1 *Uncured (wet) Sealant.* The physical properties of the uncured (wet) sealant are as follows:

Property	Requirement	Standard
Weight	717.87 lbs/cy +/- 1.0 lb. (1210 kg/cu. m. +/- 0.45 kg.)	ASTME201
Total Solids by Weight	75-86%	ASTMD1353 18 hours at 200°F (94°C)
Viscosity	0.00073-0.0123 psi-s (5-85 Pa-s)	Brookfield RVF No. 6 Spindle at 20 RPM, 77°F (25°C), 50% Rel. Hum.
Curing Time	Touch: 24 Hr. Max Complete: 36 Hr. Max 50% Rel. Hum.	ASTMD1640 4 mil (1000 µm) Film, 77°F (25°C),

2.2 *Cured Sealant.* The physical properties of the cured sealant are as follows:

Property	Requirement	Standard
Hardness (Indentation)	65 - 85	ASTMD2240 Model 1700, 25C, 50% Rel. Hum.
Tensile Strength	125 lb/in (862 kPa) Minimum	ASTMD412 Die C Pulled at 20 IPM
Elongation	200% Minimum	ASTMD412 Die C Pulled at 20 IPM
Adhesion (Peel Strength)	15 lb/in (6.8 kg/25 mm) width	ASTMD903 Canvas to Concrete
Application Temp. Range	+41°F to 131°F (+5° C to 55° C)	
Service Temp. Range	-40°F to 150°F (-40° C to 65° C)	

*Resistance:* The cured sealant shall have the following chemical resistances:

Deicing	No Effect	ASTM D471*
Gasoline	Slight Swell	ASTM D471*
Hydraulic Brake Fluid	No Effect	ASTM D471*
Motor Oil	No Effect	ASTM D471*
Sodium Chloride (5%)	No Effect	ASTM D471*

\* The ASTM Test shall be conducted at 70°F to 77°F (18° C to 25° C) for a period of 22 hours.

3. *Application of Sealant.* Unless otherwise shown on the plans, the Contractor shall apply the sealant using his own equipment. The Department reserves the right to perform any or all of the tests described in this Specification to insure compliance. Failure of a sample will require that the loops be removed and replaced with new sealant meeting this specification.

#### 828.04. CONSTRUCTION METHODS.

Install the detection loop of the system so that it will perform reliably over a long period of time. Locate the loop detection system as shown on the Plans. Mark the exact location on the roadway with chalk string, spray paint, or some suitable marking device that can withstand weather and traffic until such time as the locations have been approved by the Engineer. Cut the induction loop slot, including corner cuts, to the exact width and depth as shown on the Plans. Clean and dry the slot with compressed air to remove all water and debris. Wind all loop wires in any given location in the same direction. All loop wire shall be one continuous length to the pull box where it shall be connected to the lead-in cable. Use a blunt wood instrument for placing the wire into the slot so that the insulation is not damaged in any way. All connections that are made from loop wire to the lead-in cable shall be made only in the pull box. Solder the connection with a 60/40 alloy, rosin core solder. Take care while soldering not to damage the insulation of the wire and cable. When the connection has been completed, place a water tight connector sealing pack over it. If no lead-in cable is required, connect the loop wire directly to the terminal block that is located in the base of the traffic signal pole. After carefully placing the loop wire and backer rod in the slot and checking the circuitry, seal the slot with a sealer that meets the requirements of this Specification.

#### 828.05. METHOD OF MEASUREMENT.

The solid state digital inductive *vehicle loop detector* installed will be measured by the channel unit as specified in the plans, complete in place, wired and connected to the controller. The *loop detector wire* will be measured by the linear foot (meter) or each loop installed and connected to the loop detector.

**828.06 . BASIS OF PAYMENT.**

The accepted vehicle loop detector unit and loop detector wire, measured as provided above, will be paid for at the contract unit price as follows:

- (A) VEHICLE LOOP DETECTOR ..... EACH  
 (B) LOOP DETECTOR WIRE ..... EACH OR LINEAR FOOT (METER)

Such payment shall be full compensation for furnishing materials, labor, equipment and incidentals necessary to complete the work as specified.

## **SECTION 830 PEDESTRIAN PUSH BUTTON**

**830.01. DESCRIPTION.**

The work shall consist of furnishing materials and installing pedestrian push buttons and signs on traffic signal installations in accordance with these Specifications and as shown on the Plans.

**830.02. MATERIALS.**

The pedestrian push button switch shall meet the requirements of the "Americans with Disabilities Act", (ADA), Section 14.2.5 and be a phenolic enclosed precision snap-acting single-pole, single-throw unit with screw-type terminals rated at 5 amperes at 125 volts A. C. Materials for pedestrian information signs shall be as shown on the Plans.

**830.04. CONSTRUCTION METHODS.**

Install in accordance with ADA and construct the pedestrian push button so that it is tamper proof. Design it to prevent an electrical shock under any weather condition.

Attach the pedestrian push button and sign to a traffic signal pole or steel pipe as shown on the Plans. Shape the housing to fit the curvature of the pole or pipe and secure it to provide a rigid installation.

**830.05. METHOD OF MEASUREMENT.**

The *pedestrian push button* will be measured by the unit complete in place, connected, including signs and all hardware.

**830.06. BASIS OF PAYMENT.**

The accepted pedestrian push button, measured as provided above, will be paid for at the contract unit price as follows:

- PEDESTRIAN PUSH BUTTON ..... EACH

Such payment shall be full compensation for furnishing materials, labor, equipment, and incidentals necessary to complete the work as specified.